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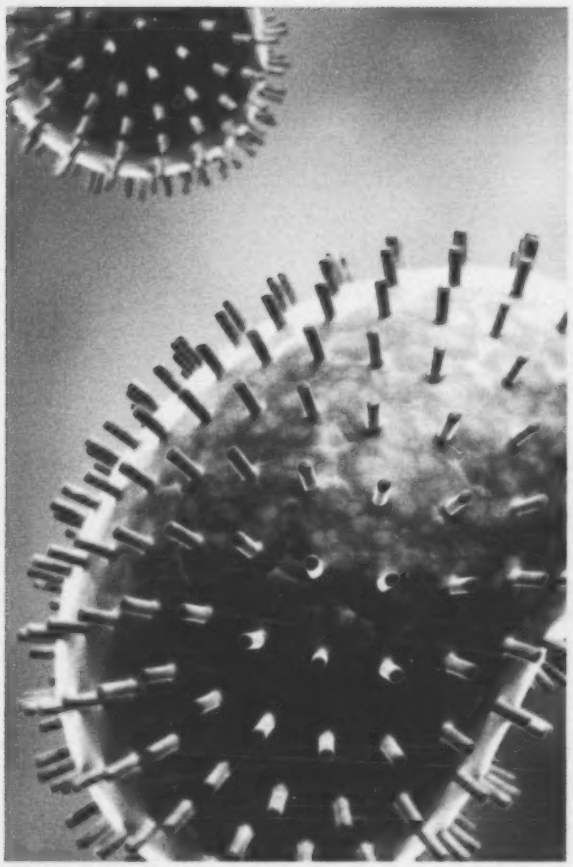
CANADA COMMUNICABLE DISEASE REPORT

EMERGING INFECTIOUS DISEASES



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CANADA COMMUNICABLE DISEASE REPORT

The Canada Communicable Disease Report (CCDR) is a bilingual, peer-reviewed, open-access, online scientific journal published by the Public Health Agency of Canada (PHAC). It provides timely, authoritative and practical information on infectious diseases to clinicians, public-health professionals, and policy-makers to inform policy, program development and practice.

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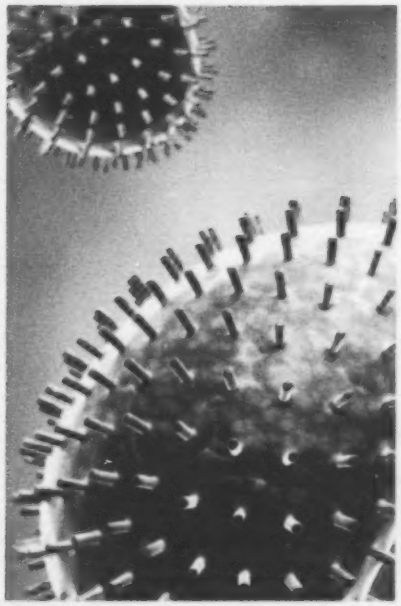

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Surveillance of the emerging enterovirus D68 in Canada: An evaluation

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Abstract

Background: In the fall of 2014, in response to outbreaks of an emerging respiratory pathogen enterovirus D68 (EV-D68) which affected mostly children, a rapid time-limited surveillance pilot for hospitalized cases was conducted in seven Canadian jurisdictions.

Objective: To evaluate whether the goals of the EV-D68 pilot were met and to determine the benefits of and lessons learned from a rapid-response surveillance system for emerging pathogens.

Methods: An evaluation survey was created and administered via a secure online link. All provinces and territories (PTs) and federal partners involved in the pilot were invited to complete one survey per jurisdiction (N=17). Proportions were calculated for responses to closed-ended questions and recurring themes were identified for open-ended questions.

Results: Fifty four percent (7/13) of PTs and 50% (2/4) of federal partners completed the survey. All four goals of the pilot were met to some degree. All respondents agreed that there were important benefits to rapid surveillance initiatives for emerging pathogens including the capacity to: better understand the epidemiological and clinical features as well as the public health risk of emerging pathogens (66.7%); inform public health action (66.7%); collaborate and avoid duplication of work (11.1%); test and develop jurisdictional capacity (11.1%); and inform future response efforts (11.1%). Receiving timely case summaries (preferably weekly) was identified as important for 88% of respondents. In terms of lessons learned, more than half of respondents (66.7%) indicated that current processes needed to be improved in order to facilitate rapid surveillance initiatives within and across jurisdictions including the need to develop data-sharing agreements and have pre-existing protocols. Important factors identified for a surveillance data reporting platform included: ease of functionality, data security, jurisdictional control, web-based and flexibility to meet changing surveillance needs.

Conclusion: Evaluation results from the EV-D68 surveillance pilot will assist with future rapid surveillance initiatives. It is important that lessons learned be addressed prior to the emergence of the next emerging pathogen.

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Introduction

Enterovirus D68 (EV-D68) is a non-polio enterovirus that often causes mild symptoms such as a cold or fever; however more severe respiratory symptoms such as difficulty breathing or wheezing may be reported in individuals, particularly children with a history of asthma or other pre-existing conditions (1). Prior to 2014, EV-D68 was rarely identified in Canada. The National Microbiology Laboratory (NML) identified only 85 EV-D68 positive isolates from 1990 to early 2014 (2).

In the fall of 2014, there was a large outbreak of EV-D68 virus in Canada,the United States (3,4) and elsewhere. The outbreak in Canada caused severe respiratory illness requiring hospitalization in over 200 children (3) and resulted in several deaths (5) as well as cases with neurological symptoms (3,5).

National surveillance of emerging respiratory infections

The administration and delivery of health care services in Canada is the responsibility of each province and territory (PT) (6), therefore federal/provincial/territorial collaboration and data sharing are required to obtain national surveillance information. There are challenges in developing a national surveillance system for emerging pathogens. Although novel avian influenza and severe acute respiratory syndrome (SARS) are now nationally notifiable (7), in general, reporting mechanisms for national

surveillance of emerging pathogens are neither available nor well established. In addition, building any surveillance system requires effort and investment (8) and this can be difficult to do the midst of an outbreak, as demonstrated during the 2003 outbreak of SARS in Canada (9).

EV-D68 severe outcomes surveillance pilot

Prior to the 2014 outbreak, illness due to EV-D68 was rare and the disease was not nationally notifiable. In the fall of 2014, concerns over initial reports of severe respiratory illness in EV-D68 cases in Canada, combined with a lack of clinical and epidemiological information on EV-D68 in general, prompted the Public Health Agency of Canada (PHAC), in collaboration with select federal and PT partners, to launch a rapid response surveillance pilot to collect data for national reporting within weeks of the outbreak. All 13 PTs were invited to participate in the time-limited rapid surveillance pilot and seven agreed: British Columbia, Alberta, Ontario, New Brunswick, Yukon, Northwest Territories and Nunavut. With this, all five regions in Canada (i.e. Atlantic, Central, Prairies, Western and the Territories) and three of the four most populous provinces were represented. In addition, PHAC's Centre for Immunization and Respiratory Infectious Diseases (CIRID), the NML, the Canadian Field Epidemiology Program and Health Canada's First Nations and Inuit Health Branch were also involved in the pilot.

The goals of the EV-D68 pilot were to: (a) collect select de-identified case-level data on severe cases of EVD68 infection in Canada requiring hospitalization; (b) describe select clinical and epidemiological characteristics of severe cases of EV-D68 infection in near-real time and at the end of the surveillance period; (c) provide participating jurisdictions with options for creating real-time summary reports (e.g, summaries of national or jurisdiction-specific data); and (d) establish a secure web-based reporting tool that could be adapted for future surveillance needs. Data on hospitalized, laboratory-confirmed cases of EV-D68 were collected from September to October 2014. A surveillance summary of pediatric cases (<=18 years of age) for the month of September 2014 was published in February 2015 (3). An evaluation of the pilot followed. The overall objectives for the evaluation of the EV-D68 pilot were to: (a) assess whether the goals of the EV-D68 pilot were met, (b) determine the benefits of a rapid-response surveillance system for emerging pathogens and (c) identify valuable lessons from the pilot process for future surveillance efforts.

Methods

PHAC conducted a qualitative evaluation of the EV-D68 pilot in the spring of 2015. The survey questions were created by the authors and developed specifically to determine whether the goals of the EV-D68 pilot were met, to determine the benefits and to identify lessons learned by articulating what worked or did not work well, including barriers or limitations that were identified throughout the surveillance pilot and what could be done to address them. (The full survey is available upon request from the corresponding author.) The survey was pilot-tested for clarity and comprehensibility by two individuals from CIRID who were not involved in the EV-D68 pilot. Respondents were reminded of which goals of the pilot the specific survey questions were applicable to and were provided with supplementary information for reference (e.g., link to the final pilot report, reminder of events/circumstances that occurred). The survey was available in English and French and administered through FluidSurveys™ (10).

Surveys were sent to the emerging pathogens surveillance leads in all PTs (n=13) and four branches or centres within the two federal departments involved in the pilot. Jurisdictions were encouraged to complete one survey each but the initial recipients could forward the survey to other individuals as appropriate. Survey respondents were informed that if multiple survey responses per jurisdiction were received, responses would be weighted appropriately so as not to bias the results. The individuals involved in planning and administrating the evaluation and those at the Canadian Network for Public Health Intelligence (CNPHI) who created the data reporting platform, did not participate in the survey as they were not among the target population. Two e-mails and two verbal reminders were sent to increase the survey's participation rate.

A variety of survey question types (e.g., multiple choice, select all that apply, open-ended) were asked. Proportions were calculated for responses to close-ended questions; recurring themes were identified from open-ended questions for which similar responses were grouped together and percentages applied accordingly. Unique responses were summarized and listed in qualitative form in the results.

Reasons for not participating in the pilot were gathered throughout the pilot process from the PTs that declined to participate (verbally during pre-scheduled EV-D68 pilot teleconferences, at the monthly respiratory surveillance teleconferences or in writing via e-mail).

Results

Participation

Fifty-four percent (7/13) of PTs and 50% (2/4) of the federal partners completed the evaluation survey. Of the respondents, all but one jurisdiction participated in the surveillance pilot. Respondents included, but were not limited to: the four jurisdictions with the largest populations in Canada and subsequently the same jurisdictions that reported the most EV-D68 cases in the fall of 2014; federal and territorial jurisdictions responsible for northern and/or Aboriginal populations; and one province from the Atlantic region. The three provinces that did not complete the survey and did not participate in the pilot provided their reasons via email.

Those jurisdictions/organizations that participated in the pilot did so because they wanted to determine the burden of EV-D68 nationally (87.5%); the virus was an emerging pathogen of public health interest (25%); and/or they wanted to better understand processes and working relationships between multi-jurisdictional partners when novel communicable diseases occur (25%). One survey respondent noted he/she did not participate in the pilot because EV-D68 was not a notifiable disease. The three provinces who did not complete the survey and did not participate in the pilot indicated via e-mail that the primary reason for not participating was due to limited capacity and resources within their province. At that time, some provincial

public health laboratories did not have the capacity to test for EV-D68 or had limited provincial human resources available to participate.

Overall experience

The official start of the pilot occurred three weeks after PHAC was notified of the first EV-D68 case in Canada. When asked, 75% of respondents indicated they were 'satisfied' or 'very satisfied' with the length of time it took to develop the pilot and initiate surveillance.

The active surveillance period lasted six to eight weeks and included retrospective case ascertainment for the month of September. The larger jurisdictions reported the majority of EV-D68 cases while few to none were reported from the smaller jurisdictions. Despite the variation in effort required per jurisdiction to collect case data, 62.5% found the amount of time and effort required to participate in the pilot was 'somewhat reasonable' and 25% found it 'very reasonable'. Overall, 62.5% found that participation in the pilot was 'somewhat satisfying'. All respondents indicated their jurisdiction/organization were provided with regular updates on the status throughout the pilot.

Goals of the surveillance pilot

The first goal was to collect select de-identified case-level data on severe cases of EV-D68 infection in Canada requiring hospitalization. All participating PTs (n=7) agreed to use the case report form provided. An accompanying web-based electronic reporting platform (developed by CNPHI) was used to collect data. However, only four of the PTs were able to identify at least one case that met the case definition and thus, only these four PTs were able to report case data.

The second goal was to describe select clinical and epidemiological characteristics of severe cases of EV-D68 infection in near-real time and at the end of the surveillance period. An epidemiological summary of the cases was provided at the end of the surveillance period. A published surveillance summary report included case data from three of the seven participating PTs and was limited to hospitalized pediatric cases <18 years who were laboratory-confirmed in the month of September (3). Despite the analyses being limited to data from a small number of jurisdictions and regarding children, 62.5% of respondents found the summary report provided was 'useful' or 'very useful'. For those who found it less useful (37.5%), the main reason was because the summary report was not representative of the national picture, particularly due to limitations in the geographic and age distributions of the cases included.

The third goal was to provide participating jurisdictions with options for creating real-time summary reports via CNPHI (e.g., summaries of national or jurisdiction-specific data). These were not provided because, of the jurisdictions that reported at least one case (n=4; all of whom completed the survey), only 50% used the case report form and only 25% used the CNPHI platform to report case information nationally.

The fourth goal was to establish a secure web-based reporting tool that could be adapted for future surveillance. Although the CNPHI platform had the capability to provide participating jurisdictions with options to create real-time summary reports, was secure, web-based and had the flexibility to adapt to user needs (e.g., allow for batch data uploads rather than manual data entry for each case, addition/deletion of data fields, etc.), uptake during the pilot was low. Some jurisdictions did not use the case report form or the CNPHI platform because they either used their own jurisdiction-specific forms or databases or they did not want to place additional burden on limited health care resources.

Benefits of a rapid surveillance initiative for emerging pathogens

All respondents indicated there was a need for rapid surveillance initiatives for emerging pathogens. Their reasons were to better understand epidemiological and clinical features and public health risk of the emerging pathogen (66.7%); to inform public health action (66.7%); to collaborate with partners and avoid duplication of work (11.1%); to test and develop jurisdictional capacity (11.1%); and because lessons learned may guide future preparation and response efforts (11.1%).

Lessons learned

More than half of respondents (66.7%) indicated that current processes should be improved in order to facilitate rapid surveillance initiatives within and across jurisdictions. Specifically, there should be more opportunities to engage in or practice rapid surveillance initiatives; ethics approvals should be expedited to enable timely data collection; and data reporting formats and mechanisms should be flexible to prevent duplication of, or avoid unnecessary effort and use of resources.

Half of the respondents indicated that data-sharing agreements or protocols should be established prior to an outbreak. For example, ensure that emerging pathogens showing epidemic or unusual features are reportable conditions under PT communicable disease regulations; ensure data-sharing agreements are in place that promotes sharing of data and support collaborative opportunities; as well as pre-existing national protocols for coordinating the response to these pathogens. Finally, 33.3% of respondents indicated that in order to facilitate rapid surveillance initiatives within and across jurisdictions, jurisdictions need to ensure that sufficient resources and staffing (e.g., surge capacity) are in place to respond to an emerging public health threat.

The majority of respondents (88%) indicated that receiving timely case summaries from PHAC throughout the pilot process was important and weekly updates were preferred. Opportunities to discuss outbreak findings and any concerns with those participating in the pilot on a regular basis were suggested.

Respondents selected the following characteristics as important in a data reporting platform: ease of functionality (100%); security of data storage and access to data (87.5%); ability to upload batch data (87.5%); ability to maintain jurisdictional control for data access and reporting (87.5%); web-based (75%); and the flexibility to rapidly create case report forms for new surveillance initiatives (62.5%).

Finally, 40% of participants suggested that barriers be identified and addressed prior to an emergent infectious disease outbreak.

For example, jurisdictions should establish mechanisms to quickly collect and report data, including data about diseases that are not necessarily reportable or notifiable. Forty percent also suggested that protocols should be established with roles and responsibilities clearly outlined for multi-jurisdictional surveillance processes. Twenty percent suggested that an inter-jurisdictional group could assess the need for and decide on whether to proceed with setting up a new surveillance system. A similar proportion suggested that from the outset, jurisdictions should place a priority on setting aggregate reporting of surveillance data to ensure timeliness of data reporting because case-level data reporting requires privacy considerations which take additional time and resources to collect.

A summary of the key evaluation findings are noted in **Table 1**.

Discussion

The key findings of the evaluation of the EV-D68 surveillance pilot were that: the four goals of the pilot were met albeit with some shortcomings; there were important benefits to conducting surveillance of emerging pathogens; and some valuable lessons were learned that could assist with future surveillance initiatives for emerging pathogens in Canada. The survey findings highlighted the following important success factors: pre-established processes and reporting mechanisms; and adequate resource capacity (particularly human resource surge capacity for additional surveillance demands). Because barriers to surveillance and reporting of pertinent case details caused delays and/or prevented jurisdictions from participating, it is recommended that barriers be identified and addressed prior to the emergence/re-emergence of respiratory pathogens to ensure timeliness in initiating such systems.

Although the surveillance pilot objectives were met, the evaluation was able to shed light on the factors that influenced the level of success achieved for each objective. For example, although a surveillance reporting platform with the ability to provide real-time summary reports was created and made available for PTs to use, uptake of the platform was sub-optimal due to preferences in using jurisdiction-specific forms/platforms. At the federal level, it is important to understand the factors that allow PTs to participate in a national surveillance initiative and what factors sustain national reporting. For example, PHAC could provide forms and reporting mechanisms that minimize undue effort and demands on already-strained PT resources.

The evaluation results should be interpreted with caution due to several limitations. First, close to half of the PTs did not participate in the surveillance pilot or complete an evaluation survey and therefore, only minimal information could be obtained on the usefulness of conducting surveillance on emerging pathogens such as EV-D68 from those jurisdictions. Most of the responses/results came from jurisdictions that participated in the pilot and depending on whether some questions were applicable to a jurisdiction or not, the denominators for percentage calculations were even smaller (i.e. fewer than five). Although non-participating jurisdictions were asked to provide their reasons for not participating, overall, feedback from nonparticipating jurisdictions was lacking. Secondly, the evaluation was conducted five months after completion of the pilot to coincide with a downturn in respiratory virus activity in the country, so as not to burden jurisdictions with the additional task of completing the survey during the active respiratory surveillance period. More complete and informative feedback may have been obtained if the survey was conducted within weeks rather than months following the completion of the pilot.

Table 1: Summary of key evaluation findings of the EV-D68 surveillance pilot

Were the goals of the EV-D68 surveillance pilot met?	1. Were select case-level data collected? Yes, but only four of the participating PTs were able to identify at least one case that met the case definition. 2. Was the clinical and epidemiologic picture of cases described in near-real time and at the end of the surveillance period? Not in near-real time but at the end of the pilot, of which 62.5% of respondents found the summary report useful. 3. Were options for creating real-time summary reports provided? Yes, however these features were not utilized due to low uptake of the electronic reporting platform. 4. Was a secure web-based reporting tool that is amenable to adaptation for future surveillance needs established? Yes, however uptake was low (only 25% used the CNPHI platform).
What were the benefits of conducting a rapid surveillance initiative for emerging pathogens?	• To better understand epidemiological and clinical features and public health risk of the emerging pathogen (66.7%). • To inform public health action (66.7%). • To collaborate with partners and avoid duplication of work (11.1%). • To test and develop jurisdictional capacity (11.1%). • Lessons learned may guide future preparation and response efforts (11.1%).
What were the lessons learned from the EV-D68 surveillance pilot?	• Improve current processes to facilitate rapid surveillance initiatives (66.7%), such as more opportunities to engage in such initiatives, expedited ethics approvals, flexible data reporting formats, obtaining data-sharing agreements and draft protocols beforehand. • Ensure sufficient surge capacity is available (both resources and staff) (33.3%). • Have regular opportunities to discuss outbreak findings and any concerns among those participating in the surveillance initiative.

The fall 2014 EV-D68 outbreak took place over a brief time period and resulted in a small number of deaths and cases with neurological manifestations. Nevertheless, the EV-D68 surveillance pilot provided PHAC and participating jurisdictions with an opportunity to test resource capacities and processes for emerging respiratory pathogens surveillance and to become better prepared to undertake future rapid surveillance initiatives.

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Conflict of Interest

None.

Funding

None.

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What happened to enterovirus D68 infections in 2015?

Harris D[1], Desai S[2], Smieja M[3], Rutherford C[4], Mertz D[1], Pernica JM[2]*

Abstract

Background: Enterovirus-D68 (EV-D68) was observed in association with severe respiratory disease in children in North America and around the world in the fall of 2014.

Objective: To compare fall 2014 detection rates with fall 2015 detection rates of EV-D68 in nasopharyngeal swab (NPS) samples collected for routine clinical care from a large regional laboratory in south-central Ontario.

Method: Consecutive NPS samples submitted from inpatients and outpatients in Hamilton, Niagara Region and Burlington to the Regional Virology Laboratory were tested with multiplex polymerase chain reaction (PCR) for rhinovirus/enterovirus (as a single target) and for other common respiratory viruses. All NPS samples positive for rhinovirus/enterovirus were reflexed to a lab-developed single target PCR for EV-D68 detection.

Results: In 2014, between August 1 and October 31, 566 of 1,497 (38%, 95%CI 35-40%) NPS samples were rhino/enterovirus positive, of which 177 (31%, 95%CI 27-35%) were confirmed as EV-D68. In 2015, between August 1 and October 31, 472 of 1,630 (29%, 95%CI 27-31%) NPS samples were rhino/enterovirus positive, of which none (0%, upper limit 97.5%CI 0.8%) were confirmed to be EV-D68.

Conclusion: Based on testing results, there appears to be much less circulating EV-D68 in south central Ontario in 2015 than in 2014. Further studies would be helpful to determine if detection rates have also dramatically decreased in other regions in Canada and internationally.

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Introduction

Enterovirus (EV) infections are ubiquitous worldwide and are responsible for significant morbidity and mortality in both children and adults (1,2,3). Though the majority of EV infections in healthy individuals are asymptomatic or associated with mild symptoms, the pathogenic potential of EV infections should not be underestimated. In East Asia, EV-71 regularly causes epidemics of hand-foot-and-mouth disease, severe neurologic disease or both (1) and intensive research has gone into the development of a vaccine against this pathogen (4,5).

In August 2014, a previously rare EV serotype, EV-D68, was isolated from children hospitalized with severe respiratory disease in the American Midwest (6) and was followed by reports of EV-D68 infections across North America (6,7,8,9,10) and Europe (11,12). The timing of the European EV-D68 spread was similar to North America. And the A and B clades circulating in Europe were very closely related to those causing the outbreak in the United States (US) and Canada (11). Community- and hospital-based surveillance in British Columbia (BC), Alberta and Quebec documented a significant eight-fold increase in circulating EVD68 in late 2014 compared to the previous year (7). There was a total of 211 cases of EV-D68 detected in BC from August 28 to December 31, with the vast majority occurring in October and November. Estimates of the overall hospitalization rate attributable to EV-D68 were as high as 21 per 100,000 in the under-five year age group (7).

Children admitted to hospital in Canada with EV-D68 infection were shown to be predominantly male and often critically ill, with 6.8 to 23% requiring intensive care (13,14). The emergence of this pathogen was felt to be a concern not only because of its association with respiratory disease but also because of the hypothesis that EV-D68 infection could lead to pediatric acute flaccid paralysis/myelitis, given the sudden temporally associated appearance across North America of numerous cases of acute flaccid paralysis or myelitis (15,16,17). It has been recently re-emphasized that it is very important to promptly detect and describe outbreaks, quantify their impact, and have national surveillance of enteroviruses in Canada (18).

Many reference laboratories in Canada now routinely use highly sensitive multiplex polymerase chain reaction (PCR)-based methods for the detection of respiratory viruses, although some reserve such tests for severe illness or surveillance. The Regional Virology Laboratory (RVL) of the Hamilton Regional Laboratory Medicine Program performs routine multiplex PCR for ten respiratory viruses, regardless of disease severity, and includes a rhinovirus/enterovirus target. The RVL tests clinical samples from acute care hospitals and urgent care centres in Hamilton, Niagara Region and Burlington, a catchment area of approximately 1.3 million inhabitants.

The objective of this study was to document the results of the RVL's nasopharyngeal specimen (NPS) testing in the fall of 2015 and compare it with results from the fall of 2014.

Methods

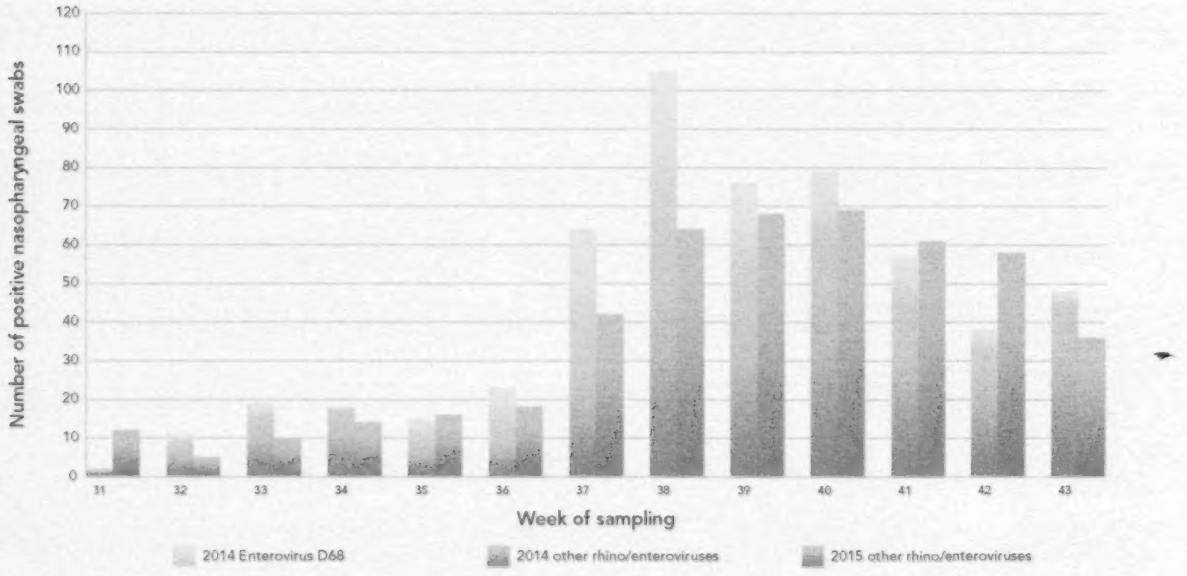
The RVL's respiratory panel contains a PCR target highly conserved among rhinoviruses and enteroviruses. This test is very sensitive for the detection of rhinovirus/enterovirus but definite pathogen identification requires a second test specific to enteroviruses. It was discovered in 2014 that the enterovirus-specific assay previously used at the RVL lacked the sensitivity of the rhinovirus/enterovirus assay and did not identify EVD68 reliably. A highly sensitive, laboratory-developed real-time PCR assay for a unique sequence within the VP1 gene of EV-D68 was developed.

Flocked NPS samples collected as part of routine care and transported in viral transport medium were extracted using the easyMag® platform (bioMérieux®, Marcy L'Etoile, France), and tested by two multiplex PCRs (one targeting influenza A and B, respiratory syncytial virus and rhinovirus/enterovirus and the other targeting parainfluenza types 1-3, metapneumovirus and adenovirus). All NPS testing results for the Region are entered weekly into a database containing date, age and clinical centre. Specific testing for EV-D68 was done with all NPS which tested positive for rhinovirus/enterovirus, received between August 1 and October 31 in both 2014 and 2015. Comparison between the proportion of all NPS samples positive for rhino/enterovirus in 2014 and 2015 was done using STATA version 11.2 (College Station, Texas).

Results

From August 1 to October 31, 2014, 38% of NPS samples (566/1,497) were rhinovirus/enterovirus positive, of which 31% (177/566) were confirmed to be EV-D68. The first EV-D68 positives were found in week 32 (August 1-9). The peak occurred in week 38 (September 15-21) and the last cases were detected in week 43 (October 20-26), with no cases detected in weeks 44 and 45 (**Figure 1**) (13). In 2015, again from August 1 to October 31, 29% of NPS samples (472/1,630) were rhinovirus/enterovirus positive, of which zero were confirmed to be EV-D68. The overall proportion of rhinovirus/enterovirus positives in 2015 was 9% less than in 2014 (95%CI 5.612% less, $p<0.001$). The timing of the peak of rhino/enterovirus activity in 2015 was in weeks 39 and 40, compared with week 38 in 2014. This may be due to the fact that schools started one week later in 2015 (**Figure 1**).

Figure 1: Weekly incidence of nasopharyngeal swabs positive for rhinovirus/enterovirus, Hamilton Regional Virology Laboratory in 2014 and 2015



Discussion

There has been no evidence of any significant or sustained EV-D68 transmission in the region in 2015, and the peak of rhinovirus/enterovirus season has passed. The timing of the EV-D68 peak in 2014 was consistent with typical rhinovirus/enterovirus circulation in the region; Canadian surveillance data have shown that hospitalizations for asthma exacerbations, primarily triggered by viral infections, peak 16.7 days (95%CI 15.8-17.5 days) after the first day of public school (19). There may have been much less circulating EV-D68 in 2015 simply because there were m[illegible] fewer susceptible individuals than there were in 2014; alternatively, EV-D68 might have been associated with less severe disease in 2015, which would also lead to diminished recognition because of fewer presentations to medical professionals. Since the population served by the Regional Virology Laboratory is large, reflected in part by the fact that in 2014 there were almost as many EV-D68 positives in its catchment as in the entire province of BC, it may be that other Canadian regions will also experience diminished EV-D68 activity in 2015.

There have been no cases of acute flaccid paralysis or myelitis diagnosed in our region during the current enterovirus season and the lack of circulating EV-D68 leads the authors to be cautiously optimistic that an increased incidence of neurologic disease will not be observed this year. However, the possibility of a late spike in circulating rhino/enteroviruses cannot be ruled out and therefore regional surveillance will continue. EV-D68, for now, continues to be a public health issue of relevance, given its known ability to cause respiratory disease and possible association with severe neurologic sequelae in children.

Conflict of interest

None.

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ADVISORY COMMITTEE STATEMENT

CATMAT statement on disseminated strongyloidiasis: Prevention, assessment and management guidelines

Boggild AK[1,2,3], Libman M[4], Greenaway C[5], McCarthy AE[6], on behalf of the Committee to Advise on Tropical Medicine and Travel (CATMAT)*

Abstract

Background: *Strongyloides stercoralis* is a parasitic nematode found in humans, with a higher prevalence in tropical and sub-tropical regions worldwide. If untreated, the infection can progress to disseminated strongyloidiasis, a critical illness which may be fatal.

Objective: To provide clinical guidance on the prevention, assessment and management of disseminated strongyloidiasis.

Methods: A literature review was conducted to evaluate the current evidence and to identify any systematic reviews, case reports, guidelines and peer reviewed and non-peer reviewed medical literature. The Committee to Advise on Tropical Medicine and Travel (CATMAT) assembled a working group to develop this statement, which was then critically reviewed and approved by all CATMAT members.

Recommendations: CATMAT recommends that screening for strongyloidiasis should be considered for individuals with epidemiologic risk and/or co-morbidities that place them at risk for *Strongyloides* hyperinfection and dissemination. Those at highest risk of hyperinfection and dissemination are individuals born in a *Strongyloides*-endemic area who undergo iatrogenic immunosuppression or have intercurrent human T-lymphotropic virus (HTLV-1) infection. Diagnosis of strongyloidiasis is based on serologic testing and/or examination of stools and other clinical specimens for larvae. Referral to a tropical medicine specialist with expertise in the management of strongyloidiasis is recommended for suspected and confirmed cases. A diagnosis and treatment algorithm for strongyloidiasis has been developed as a reference tool.

Conclusion: Strongyloidiasis is relatively widespread in the global migrant population and screening for the disease should be based on an individual risk assessment. A practical tool for the clinician to use in the prevention, assessment and management of disseminated strongyloidiasis in Canada is now available.

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Preamble

The Committee to Advise on Tropical Medicine and Travel (CATMAT) provides the Public Health Agency of Canada with ongoing and timely medical, scientific and public health advice relating to tropical infectious disease and health risks associated with international travel. The Agency acknowledges that the advice and recommendations set out in this statement are based upon the best current available scientific knowledge and medical practices and is disseminating this document for information purposes to both travellers and the medical community caring for travellers.

Persons administering or using drugs, vaccines or other products should also be aware of the contents of the product monograph(s) or other similarly approved standards or instructions for use. Recommendations for use and other information set out herein may differ from that set out in the product monograph(s) or other similarly approved standards or instructions for use by the licensed manufacturer(s). Manufacturers have sought approval and provided evidence as to the safety and efficacy of their products only when used in accordance with the product monographs or other similarly approved standards or instructions for use.

Introduction

Strongyloidiasis is a disease caused by a nematode (i.e., a roundworm), which is present mainly in tropical and sub-tropical regions, but also in temperate climates. Precise data on prevalence are unknown in endemic countries; however, it is estimated that 30-100 million people are infected worldwide (1). Most people who are infected with *Strongyloides* are asymptomatic and unaware of their infection; however, people who are immunosuppressed are at risk of developing the severe form of disseminated strongyloidiasis which, if untreated, can lead to potentially fatal illness (2). Although strongyloidiasis has traditionally been considered a tropical disease, increased worldwide travel and immigration have led to an increased number of cases seeking medical care in Canada.

The objectives of this statement are to:

1. Raise awareness of disseminated strongyloidiasis among clinicians who may encounter these cases (including front-line clinicians such as emergency room physicians, infectious diseases specialists, rheumatologists, dermatologists, gastroenterologists, oncologists, intensivists and transplant teams).
2. Assist clinicians in the prevention, assessment and management of disseminated strongyloidiasis.

Methods

This statement was created after CATMAT identified a need to inform Canadian clinicians about disseminated strongyloidiasis. A CATMAT working group was assembled and a member was elected to lead the statement development. The available literature was assessed for systematic reviews, guidelines, case reports and peer reviewed and non-peer reviewed medical literature. Based on the evidence compiled as well as expert opinion, a diagnosis and treatment algorithm for strongyloidiasis was designed as a reference tool for clinicians in Canada. The statement was then critically reviewed and approved by all CATMAT members.

Epidemiology

Strongyloides stercoralis is a parasitic nematode of humans, which is found throughout the tropics and subtropics worldwide. High prevalence of infection is found focally in the Caribbean, in West and East Africa and particularly Southeast Asia (3). Data support that anywhere between 10% to 40% of the population in tropical and sub-tropical regions are affected by strongyloidiasis, with rates as high as 60% in countries with ecologies and socioeconomic factors permissive to the transmission of *S. stercoralis* (3). A Canadian study of refugees documented a 77% seroprevalence among refugees from Cambodia and a 12% seroprevalence among refugees from Vietnam (4). Furthermore, strongyloidiasis was the fifth most common diagnosis among 1,321 ill new immigrants presenting for care at a Canadian Travel Medicine Network (CanTravNet) site over a three-year period (5,6). Given that 6.8 million Canadians are foreign born, with approximately 85% emigrating from regions endemic for strongyloidiasis (7), a substantial proportion of the immigrant and refugee population of Canada is at risk for strongyloidiasis. Asia continues to be the largest source region for immigrants to Canada, with the Philippines, China and India serving as the top single source countries (7). Immigrant populations from Africa, the Caribbean, Central and South America are increasing over time as well (7).

In Canada, approximately 2.5-million individuals are estimated to have simple intestinal strongyloidiasis, assuming a source country prevalence of 40% (3). This estimate excludes travel-acquired strongyloidiasis, which is expected to account for a minority of cases in Canada. However, it is important to recognize that even short-term travel to highly endemic areas may be associated with acquisition of strongyloidiasis (8,9,10).

It is difficult to estimate the proportion of Canadian immigrants and refugees who are at risk of developing disseminated strongyloidiasis, such as individuals who require iatrogenic immunosuppression or have HTLV1 co-infection.

Pathogenesis

Strongyloidiasis is acquired when infectious larvae, found in sand or soil, penetrate intact human skin and after an obligatory tissue migration phase, mature into adults in the small bowel. Unlike other parasitic helminths, *Strongyloides* has an indefinite lifespan in the human host and due to an autoinfection cycle whereby infective stage larvae re-penetrate host skin or bowel, clinical disease is a lifelong risk unless treated.

Clinical features

Strongyloides infection may cause a spectrum of illness ranging from asymptomatic eosinophilia to gastrointestinal symptoms to accelerated autoinfection (or "hyperinfection syndrome") to fulminant and fatal disseminated disease. Immune suppression such as that which occurs in the setting of prolonged corticosteroid therapy, HTLV-1 infection, or hematologic malignancy, is a risk factor for disseminated strongyloidiasis (11,12,13,14), an entity documented to carry a mortality rate in excess of 85% (15,16). The exact mechanisms for immunologic control of this infection are unclear.

Diagnosis and screening

The Canadian Consortium on Refugee and Immigrant Health (CCRIH) has recently recommended *Strongyloides* screening only for refugees from Southeast Asia and Sub-Saharan Africa (17). Broader based screening was not recommended as there are little data on the prevalence of strongyloidiasis in immigrant populations and serologic screening is not easily or rapidly available in many parts of Canada. It has been our collective clinical experience, however, that strongyloidiasis is widespread in the global migrant population and screening should be based on a risk assessment, taking into account the risk of exposure to *Strongyloides*, the risk of disseminated disease and the presenting clinical syndrome (including asymptomatic persons who are planned to undergo iatrogenic immune suppression). This is supported by a case series in Toronto that documented ten cases of disseminated strongyloidiasis over

a seven-month period, all of which occurred in immigrants to Canada, originating from Southeast Asia, the Caribbean, South America or Italy (11). Collectively, members of CATMAT have contributed to the care of patients with strongyloidiasis arising from travel to or residence in the Mediterranean, all parts of Africa, the Caribbean and Latin America, South Asia including the Indian subcontinent and the very high risk Southeast Asia. Thus, we recommend careful consideration of epidemiologic risk as outlined below in order to inform screening decisions.

Due to the low sensitivity of stool examination for ova and parasites (O&P) arising from low larval burden and intermittent shedding in the stool, serologic testing is the diagnostic method of choice in the patient suspected to have simple intestinal strongyloidiasis.

It is important to note that sensitivity of serology may be reduced in the patient with immunosuppression, especially due to HTLV-1 infection or hematologic malignancy and associated chemotherapy (18,19). These individuals are also at risk of developing disseminated strongyloidiasis and screening should generally involve both serologic and stool testing as outlined below. A stool O&P sample that is positive for *Strongyloides* larvae should prompt screening for HTLV-1 infection and referral to a specialist in tropical medicine with expertise in the management of strongyloidiasis. Physician members of the Canadian Malaria Network are available to provide advice in such cases (20).

Treatment

The drug of choice for treatment of simple intestinal and asymptomatic strongyloidiasis is ivermectin (15,21) given in two doses. Persons born or with prolonged residence in nations of the rainforest area of central Africa (e.g., Cameroon, Equatorial Guinea, Gabon, Central African Republic, Congo and the Democratic Republic of the Congo, as well as southern areas of Nigeria, Chad, South Sudan and northern Angola) should have high microfilaremic loiasis excluded prior to administration of ivermectin. This should be done by daytime blood film examination for microfilaria of Loa loa.

For *Strongyloides* hyperinfection or dissemination syndrome, CATMAT recommends dual-therapy with ivermectin and albendazole as outlined below, which is based on case report data (11,22,23,24,25), expert opinion and the clinical experience of CATMAT members. Clinical specimens, including sputum and stool, should be rechecked periodically during the course of treatment of *Strongyloides* hyperinfection or dissemination to ensure clearance of larvae.

In order to prevent the development of disseminated strongyloidiasis, patients at risk for treatment failure or complications, such as those with HTLV-1 or Loa loa co-infection, should be referred to a tropical medicine specialist with expertise in the management of such infections. There is no evidence to support that a "test and treat" strategy is superior or more cost-effective compared to empiric administration of ivermectin to at risk individuals about to undergo immune suppression (26). As access to ivermectin is limited in Canada, CATMAT recommends that empiric treatment be reserved for individuals whose planned immune suppression cannot await diagnostic testing, as outlined in Step 3 of the diagnosis and treatment algorithm below.

Any patient with disseminated strongyloidiasis should also receive empiric treatment with broad-spectrum antibiotics to cover polymicrobial sepsis, a common complication of the hyperinfection syndrome. Both albendazole and ivermectin are pregnancy category C agents. In a pregnant person with *Strongyloides* hyperinfection or dissemination, the benefits of treatment likely outweigh the risks due to the life threatening nature of disseminated strongyloidiasis. Ivermectin and albendazole are only available in Canada through the Special Access Programme of Health Canada (27). Applications to the program typically have a one week turnaround time, although emergency use, same-day requests may be made by telephone.

Infection control issues

Patients with disseminated strongyloidiasis should be managed in contact precautions due to the risk of infectious filariform larvae being shed in effluents such as stool, urine, sputum and endotracheal aspirates. Most of these patients are critically unwell and require intensive nursing and medical care, thus precautions to prevent nosocomial transmission to health care workers is important. However, it must be noted that nosocomial transmission is a theoretical risk that has not been well documented in the literature (28,29).

Contact precautions are also recommended for laboratory workers, due to the potential risk of encountering infectious filariform larvae, particularly in cultures of stool or sputum that have been sent to the laboratory to exclude bacterial infection. Agar plates of specimens from patients with disseminated strongyloidiasis should be handled with gloves and sealed with Parafilm® tape. Filariform larvae of other nematode helminths are susceptible to 70% ethanol for 10 minutes, 0.5% Dettol® for 20 minutes and chlorinated hydrocarbons (tetrachloroethylene) (30). Filariform larvae can also be inactivated by water heated above 80°C (30). Household contacts of patients with disseminated strongyloidiasis or *Strongyloides* hyperinfection syndrome should be screened for strongyloidiasis serologically and by stool examination in order to identify person to person transmission.

Diagnosis and treatment algorithm for strongyloidiasis – Steps 1-4

Note to reader: All steps are to be completed sequentially, as Step 3 requires input from Steps 1 and 2.

Step 1: Define risk category for disseminated strongyloidiasis based on epidemiologic and clinical factors

Epidemiologic risk category for *Strongyloides* exposure/Infection	Clinical risk factors for disseminated *Strongyloides*	
	• HTLV-1[1] infection • Glucocorticoid[2] therapy • Immunomodulatory agent[3] • Hematologic malignancy	• No known defects in cell-mediated immunity
Birth or residence or long-term travel[4] in Southeast Asia, Oceania, Sub-Saharan Africa, South America, Caribbean	High	Moderate
Birth or residence or long-term travel[4] in Mediterranean countries, Middle East, North Africa, Indian sub-continent, Asia	Moderate	Low
Birth or residence or long-term travel[4] in Australia, North America[5] or Western Europe	Very low	Very low

1 HTLV-1 = Human T-lymphotropic virus
2 Equivalent to 20 mg/day of prednisone for ≥2 weeks.
3 Includes: alkylating agents, antimetabolites, immunosuppressive or immunomodulatory agents used in the management of solid-organ transplant and multiple sclerosis, tumor necrosis factor (TNF), Interleokin 1 (IL-1) and adhesion blocking agents, lymphocyte depleting agents.
4 Defined as cumulative six-month exposure in rural or beach areas, or contact of skin with sand or soil in a risk area even during shorter-term travel (8,9,10). If significant re-exposure accumulates, consider re-screening if initially negative.
5 Areas of North America that may be higher than low risk include Florida, Kentucky and Virginia. Aboriginal Australians are at elevated risk of strongyloidiasis.

Step 2: Define suspected clinical syndrome

Suspected clinical syndrome	Appropriate diagnostic test	Appropriate diagnostic specimen
Asymptomatic ± eosinophilia (This would include asymptomatic individuals undergoing planned immune suppression.) (Very low risk)	• Serology • Stool ova and parasites (O&P) examination	• Serum • SAF[4]-preserved stool specimen
Simple intestinal strongyloidiasis[1] (Low risk)	• Serology • Stool O&P examination	• Serum • SAF-preserved stool specimen
Mild hyperinfection syndrome[2] (Moderate risk)	• Serology • Stool O&P examination • Sputum O&P examination • Agar plate culture	• Serum • SAF-preserved stool specimen • Fresh sputum in sterile container • Fresh stool/sputum for agar plate culture
Disseminated strongyloidiasis[3] (High risk)	• Serology • Stool O&P examination • Sputum O&P examination • Urine O&P examination • CSF[5] O&P examination • Tissue O&P examination • Agar plate culture	• Serum • SAF-preserved stool specimen • Fresh sputum in sterile container • Urine in sterile container • CSF in sterile container • Tissue, paraffin-embedded or unprocessed • Any fresh specimen as above for agar plate culture

1 Characterized by weight loss, abdominal discomfort and loose stools, with or without eosinophilia.
2 Symptoms of intestinal strongyloidiasis plus respiratory symptoms (cough, wheezing, dyspnea) with or without immunosuppression. (corticosteroids, HTLV-1 infection, malignancy, non-steroidal immunomodulating agents) and absence of signs of systemic toxicity or sepsis; all persons shedding larvae of *Strongyloides* should be screened for intercurrent HTLV-1 infection.
3 Severe clinical syndrome characterized by Gram-negative or polymicrobial sepsis and/or meningitis, with evidence of end-organ failure, including acute renal failure, acute respiratory distress, impaired consciousness, coma.
4 SAF = Sodium acetate-acetic acid-formalin
5 CSF = Cerebrospinal fluid

Step 3: Suggested diagnostic and empiric management approach based on identified risk category (Step 1) and clinical syndrome (Step 2)

Risk category (as per Step 1)	Suspected clinical syndrome (as per Step 2)			
	Asymptomatic ± eosinophilia[1]	Simple intestinal strongyloidiasis	Mild hyperinfection syndrome	Disseminated strongyloidiasis
High	Send appropriate specimens for diagnostic testing[2] (Moderate risk)	Empiric treatment while awaiting diagnostic testing (High risk)	Empiric treatment while awaiting diagnostic testing (High risk)	Empiric treatment while awaiting diagnostic testing (High risk)
Moderate	Send appropriate specimens for diagnostic testing (Moderate risk)	Send appropriate specimens for diagnostic testing (Moderate risk)	Empiric treatment while awaiting diagnostic testing (High risk)	Empiric treatment while awaiting diagnostic testing (High risk)
Low	Send appropriate specimens for diagnostic testing (Low risk)	Send appropriate specimens for diagnostic testing (Low risk)	Send appropriate specimens for diagnostic testing (Low risk)	Send appropriate specimens for diagnostic testing (Low risk)
Very low	Screening not recommended. Consider alternate diagnosis (Very low risk)	Screening not recommended. Consider alternate diagnosis (Very low risk)	Send appropriate specimens for diagnostic testing (Very low risk)	Send appropriate specimens for diagnostic testing (Very low risk)

1 This includes asymptomatic individuals undergoing planned immune suppression.

2 In the rare circumstance where the patient is deemed high risk for strongyloidiasis and immunosuppression cannot await definitive diagnostic testing, we recommend empiric treatment with two doses of ivermectin as outlined in Step 4 below.

Step 4: Treat strongyloidiasis according to clinical syndrome and diagnostic results

Clinical syndrome	Diagnostic confirmation	Adult management	Pediatric management
Asymptomatic ± eosinophilia (including asymptomatic individuals undergoing planned immune suppression) (Very low risk)	• Serology • Stool ova and parasites (O&P) examination for larvae	Ivermectin 200 µg/kg/day po once daily x 2 doses on day 1 and 2, or 14-days apart[1]	Ivermectin 200 µg/kg/day po once daily x 2 doses on day 1 and 2, or 14-days apart[1]
Simple intestinal strongyloidiasis[2] (Low risk)	• Serology • Stool O&P examination for larvae	Ivermectin 200 µg/kg/day po once daily x 2 doses on day 1 and 2, or 14-days apart[1]	Ivermectin 200 µg/kg/day po once daily x 2 doses on day 1 and 2, or 14-days apart[1]
Mild hyperinfection syndrome[3] (Moderate risk)	• Serology • Stool O&P • Sputum O&P examination for larvae	Ivermectin 200 µg/kg/day po once daily x 2 doses on day 1 and 2, or 14-days apart[1] PLUS Albendazole 400 mg po BID x 7 days OR, Monotherapy: Ivermectin 200 µg/kg/day po once daily x 7 days	Ivermectin 200 µg/kg/day po once daily x 2 doses on day 1 and 2, or 14-days apart[1] PLUS Albendazole 400 mg po BID x 7 days OR, Monotherapy: Ivermectin 200 µg/kg/day po once daily x 7 days
Disseminated strongyloidiasis[4,5] (High risk)	• Serology • Stool O&P examination for larvae • Sputum O&P examination for larvae • Urine, cerebrospinal fluid (CSF) or other body fluid or tissue examination for larvae.	Ivermectin 200 µg/kg/day po or sc[6] once daily PLUS Albendazole 400 mg po BID until cessation of larval shedding and clinical improvement	Ivermectin 200 µg/kg/day po or sc[6] once daily PLUS Albendazole 400 mg po BID until cessation of larval shedding and clinical improvement

1 A 14-day dosing interval is preferred due to the risk of prepatent infection arising from autoinfection (15).

2 Characterized by weight loss, abdominal discomfort and loose stools, with or without eosinophilia.

3 Symptoms of intestinal strongyloidiasis plus respiratory symptoms (cough, wheezing, dyspnea) with or without immunosuppression (corticosteroids, HTLV-1 infection, malignancy, non-steroidal immunomodulating agents) and absence of signs of systemic toxicity or sepsis; all persons shedding larvae of *Strongyloides* should be screened for intercurrent HTLV-1 infection.

4 Severe clinical syndrome characterized by Gram-negative or polymicrobial sepsis and/or meningitis, with evidence of end-organ failure, including acute renal failure, acute respiratory distress, impaired consciousness, coma.

5 Patients with disseminated strongyloidiasis should also receive empiric coverage of polymicrobial sepsis with broad-spectrum antibiotics.

6 Available only as a veterinary formulation; use in humans is off-label and not Health Canada approved (25,31,32,33)

Conclusion

Strongyloidiasis is relatively widespread in the global migrant population. Screening for the disease should be based on an individual risk assessment, taking into account the risk of exposure to *Strongyloides*, the risk of disseminated disease and the presenting clinical syndrome (which may include asymptomatic persons who are planned to undergo iatrogenic immune suppression). This statement summarizes the available relevant information on strongyloidiasis and provides a practical tool for the clinician to use in the prevention, assessment and management of disseminated strongyloidiasis in Canada.

Key points

- Screening for strongyloidiasis should be considered for individuals with epidemiologic risk and/or comorbidities that place them at risk for *Strongyloides* hyperinfection and dissemination. Those at highest risk of hyperinfection and dissemination are individuals born in a *Strongyloides*-endemic area who undergo iatrogenic immunosuppression, or have intercurrent HTLV-1 infection.
- Diagnosis of strongyloidiasis rests on serologic testing and/or examination of stools and other clinical specimens for larvae. Serology is generally highly sensitive, while stool examination is highly specific.
- Performance characteristics of diagnostic tests may be altered by immune suppression and coinfections such as HTLV-1, in that stool examination sensitivity may improve, while sensitivity of serology may decline.
- Referral to a tropical medicine specialist with expertise in the management of strongyloidiasis is recommended for any patient with suspected or confirmed disseminated strongyloidiasis and for patients with both *Strongyloides* and HTLV-1 or Loa loa infections.

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Conflict of interest

None.

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Information for authors
January 2016

Introduction

The Canada Communicable Disease Report (CCDR) is a bilingual, peer-reviewed, open-access, online scientific journal published by the Public Health Agency of Canada (the Agency). It provides timely and practical information on infectious diseases to clinicians, public health professionals and policy makers. CCDR is published on the first Thursday of every month (unless it is a civic holiday, in which case it is published on the following Thursday). In addition, occasional CCDR supplements are published.

What we are looking for

We welcome submissions of manuscripts from across Canada and elsewhere with practical, authoritative information on infectious diseases that will inform communicable disease policy, program and practice. CCDR follows the recommendations of the International Committee of Medical Journal Editors (ICMJE) (1) and the Treasury Board of Canada Secretariat policies on publishing, official languages (2), and web accessibility (3). CCDR does not contain policy statements, except as summaries of Advisory Committee statements. Authors retain the responsibility for the content of their articles; opinions expressed are not necessarily those of the Agency.

Types of articles

The table below identifies the types of articles commonly published in CCDR. The word counts are for the main body of the text, and do not include the abstract, tables or references. Checklists for each article type are available upon request (ccdr-rmtc@phac-aspc.gc.ca).

The types of articles published in CCDR
(in alphabetical order)

Type of article (word count)	Description
Commentary (1,000-1,500 words)	Addresses a stand-alone issue, setting forth both the strengths and arguments to support a particular point of view as well as outlining potential weaknesses and counter-arguments.
Epidemiologic study (1,500-2,000 words)	Includes cohort and case-control studies on infectious diseases as per the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (4) guidelines.
Implementation science (1,500-2,000 words)	Describes an innovative process, policy or program designed to monitor or decrease the impact of an infectious disease and generally includes an evaluation of how it worked.
Invited editorial (1,000-1,500 words)	Comments on one or several articles being published in the same issue, often placing it/them into a broader context.
Outbreak report (2,000-2,500 words)	Provides information on an outbreak, summarizing its epidemiology, risk factors, associated morbidity and mortality, public health interventions, and outcomes.
Overview (1,500-2,000 words)	Summarizes content from many specialized articles or sources into one broadly scoped article, or provides an introduction to a topic for those who may be reading about issues outside their field of expertise.
Rapid communication (750-1,500 words)	Provides a short, timely and authoritative report of an emerging or re-emerging infectious disease that typically includes the results of preliminary investigations and any interim clinical and public health recommendations.
Report Summary (500-1,000 words)	Includes an abstract and a short summary of the Agency or Advisory Committee reports with links to the full report or statement.
Surveillance report (2,000-2,500 words)	Summarizes the trends in the incidence or prevalence of an infectious disease in Canada.
Systematic review (2,000-2,500 words)	Provides a review of the literature on an infectious disease topic according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (5) guidelines.

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Manuscripts may be submitted in either English or French, and should be prepared using Microsoft Word (.docx). Identify the author(s) and their primary affiliation(s), and provide an email address for the corresponding author. For research articles, include a 200- to 250-word structured abstract (Background, Objective, Methods, Results, and Conclusion). For commentaries and editorials include a 150- to 200-word text abstract. Tables

and figures should be sent as separate files. Figures need to be created as editable files, such as Excel or PowerPoint, to permit formatting and translation.

Acknowledgements, funding sources and conflict of interest statements

At the end of the article, add an acknowledgement section to thank anyone who contributed to the development of the paper (but did not meet the requirements for authorship). Note any funding sources in a separate section (if relevant), and add a conflict of interest statement, even if only to state "None."

Manuscript submission

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Attach an ICMJE Conflict of Interest (6) form from each author.

How manuscripts are processed

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After considering the reviewers' comments, the Editor-in-Chief decides whether to request revisions or return the manuscript to the author. If revisions are indicated, an editor sends the reviewers' comments and any additional editorial comments to the corresponding author and requests revision. When the revised manuscript is received, the Editor-in-Chief then makes the final decision whether to accept it, decline it, or request additional revisions. The corresponding author is notified by email of the editorial decision.

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References

1. International Committee of Medical Journal Editors. Recommendations. http://www.icmje.org/recommendations/.
2. Treasury Board of Canada Secretariat. Policy on official languages. http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=26160.
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Human cases of West Nile virus in Canada, 2015

Source: Public Health Agency of Canada. **Surveillance of West Nile virus** - http://healthycanadians.gc.ca/diseases-conditions-maladies-affections/disease-maladie/west-nile-nil-occidental/surveillance-eng.php

During the West Nile virus season (mid-April to October), Canada conducts ongoing human case surveillance across the country. Monitoring West Nile virus nationally is a joint effort between the Government and its partners, including provincial and territorial ministries of health, First Nations authorities and blood supply agencies.

The Government relies on the provinces and territories to report the number of West Nile virus cases. To accurately reflect the annual occurrence of West Nile virus cases in Canada, health professionals need to remain vigilant in diagnosing West Nile virus, and reporting cases to their public health regional authorities. Case definitions can be accessed at: National Surveillance for West Nile virus (http://healthycanadians.gc.ca/diseases-conditions-maladies-affections/disease-maladie/west-nile-nil-occidental/surveillance-eng.php).

West Nile virus clinical cases in Canada, reported as of December 19, 2015

Province or Territory	Total number of clinical cases
Newfoundland and Labrador	0
Prince Edward Island	0
Nova Scotia	0
New Brunswick	0
Quebec	40
Ontario	33
Manitoba	5
Saskatchewan	0
Alberta	0
British Columbia	0
Yukon	0
North West Territories	0
Nunavut	0
Canada	78

Cases of West Nile virus reported annually, 2002 - 2015

Year	Number of human cases
2002	414
2003	1481
2004	25
2005	225
2006	151
2007	2215
2008	36
2009	13
2010	5
2011	101
2012	428
2013	115
2014	21
2015	78

Useful links

International Society for Infectious Diseases. **ProMED - the Program for Monitoring Emerging Diseases** - is an Internet-based reporting system dedicated to rapid global dissemination of information on outbreaks of infectious diseases and acute exposures to toxins that affect human health.
http://www.promedmail.org/aboutus

Upcoming

March 30-April 2, 2016. **Association of Medical Microbiology and Infectious Disease Canada - AMMI Annual Conference.** Vancouver, British Columbia.
https://www.ammi.ca/annual-conference/

CCDR

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